U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Eurycea waterlooensis*

COMMON NAME: Austin blind salamander

LEAD REGION: 2

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X_ Continuing candidate

___ Non-petitioned

_X_ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_ 12-month warranted but precluded - FR date:

_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

Higher priority listing actions, including court-approved settlements, court-ordered statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for Austin blind salamander. We continue to monitor Austin blind salamander populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current Candidate Notice of Review (CNOR) provides information on listing actions taken during the last 12 months.

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): June 2002

___ Candidate removal: Former LP: ___

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Amphibian, Family Plethodontidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Texas

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Travis County, Texas

LAND OWNERSHIP: The only known locations for the Austin blind salamander are within a city park owned by the City of Austin and operated by the City of Austin Parks and Recreation Department. The recharge and contributing zones of the Barton Springs Segment of the Edwards Aquifer are a combination of municipal and privately owned lands.

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LEAD FIELD OFFICE CONTACT: Austin Ecological Services, Paige Najvar, 512-490-0057, *Paige_Najvar@fws.gov*

BIOLOGICAL INFORMATION

<u>Species Description</u>: A morphological description of the Austin blind salamander was published by Hillis *et al*. (2001, pp. 268-273). This species has external feathery gills, a pronounced extension of the snout, no external eyes, 12 costal grooves, and weakly developed tail fins. In general appearance and coloration, the Austin blind salamander is more similar to the Texas blind salamander (*Eurycea rathbuni*) that occurs in the Southern Segment of the Edwards Aquifer than its sympatric species (occurring within the same range), the Barton Springs salamander (*Eurycea sosorum*). The Austin blind salamander has a reflective, lightly pigmented skin with a pearly white or lavender appearance (Hillis *et al*. 2001, p. 271).

<u>Taxonomy</u>: The U.S. Fish and Wildlife Service (Service) has carefully reviewed the available taxonomic information for the Austin blind salamander and has reached the conclusion that the species is a valid taxon. A taxonomic description of the Austin blind salamander was published by Hillis *et al*. (2001, pp. 273-278). Juvenile salamanders had been sighted occasionally in Barton Springs and thought to be a variation of the Barton Springs salamander (*Eurycea sosorum*). However, the observed juveniles more closely resembled the Texas blind salamander (*Eurycea rathbuni*), and it wasn't until recently that enough specimens were available to formally describe these juveniles as a separate species using morphological and genetic characteristics (Hillis *et al*. 2001, p. 267).

Habitat/Life History: The Austin blind salamander occurs in and around Barton Springs in Austin, Texas. These springs are fed by the Barton Springs Segment of the Edwards Aquifer. This segment covers roughly 155 square miles (401 square kilometers) from southern Travis County to northern Hays County, Texas (Barton Springs/Edwards Aquifer Conservation District 2004, p. 7). It has a storage capacity of over 300,000 acre-feet. The Edwards Aquifer is a karst aquifer characterized by open chambers such as caves, fractures, and other cavities that were formed either directly or indirectly by dissolution of the subsurface rock formations. Given the reduced eye structure of the Austin blind salamander and the fact that it is rarely seen at the surface (Hillis *et al*. 2001, p. 267), this salamander is thought to be more subterranean than the aquatic surface-dwelling Barton Springs salamander.

This salamander is a fully aquatic and neotenic species, meaning they retain their larval, gill-breathing characteristics throughout their lives. These neotenic salamanders do not metamorphose and leave water. Instead, they live in water throughout their life cycle where they become sexually mature and eventually reproduce.

The Austin blind salamander inhabits relatively stable aquatic conditions at Barton Springs. These conditions consist of perennially flowing spring water that is generally clear, clean, mostly neutral (pH about 7), and stenothermal (narrow temperature range) with an average annual temperature of 21° to 22°C (about 70° to 72°F) (City of Austin 1997, p. 144).

Historical and Current Range/Distribution: The Austin blind salamander is found in three of the four Barton Springs outlets in the City of Austin’s Zilker Park, Travis County, Texas: Parthenia (Main) Springs, Eliza Springs, and Sunken Garden (Old Mill or Zenobia) Springs. The Main Springs form the Barton Springs swimming pool. The contributing zone for the Barton Springs Segment of the Edwards Aquifer that supplies water to the salamander’s spring habitat extends into both Travis and Hays counties, Texas. The Austin blind salamander has not been observed at the fourth Barton Springs outlet, known as Upper Barton Springs (Hillis *et al*. 2001, p. 273). These spring sites have been significantly modified for human use. The area around Main Springs was impounded in the late 1920s to create Barton Springs Swimming Pool, and flows from Eliza and Sunken Garden Springs are also retained by concrete structures, forming small pools on either side of Barton Springs Pool (City of Austin 1998, p. 6, Service 2005, p. 1.6-25).

Population Estimates/Status: From January 1998 to December 2000, there were only 17 documented observations of the Austin blind salamander. During this same time frame, 1,518 Barton Springs salamander observations were made (Hillis *et al*. 2001, p. 273). Because it is not observed at the surface as often as the Barton Springs salamander (Hillis *et al*. 2001, p. 267), it is believed that this species spends a large portion of its life underground. Although the technology to safely and reliably mark salamanders for individual recognition has recently been developed (O’Donnell *et al*. 2008, p. 3), population estimates for this species have not been undertaken. Also, surveying within the Edwards Aquifer cannot be done at the current time.   For these reasons, population estimates are not currently possible. When they are found, the Austin blind salamanders appear to occur in relatively low numbers (City of Austin, unpublished data 2008). Most of the Austin blind salamanders that were observed during these surveys were juveniles (less than 1 inch (2.5 centimeters) in total length).

THREATS:

We have no new information as of April 2010 regarding threats to the species.

A. The present or threatened destruction, modification, or curtailment of its habitat or range. The range of the Austin blind salamander is limited to three of the four spring outlets that comprise Barton Springs within the City of Austin in Travis County, Texas (Hillis *et al*, 2001, p. 273). Travis County is experiencing rapid human population growth. For example, census data indicate that the population of Travis County increased 20 percent from April 2000 (population 812,280) to July 2007 (population 974,365) (U.S. Census Bureau 2009b, p. 1). Population projections from the Texas State Data Center (2009, p. 19) estimate that Travis County will continue to increase in population, reaching a population of 1,394,738 by 2040. The population within the vicinity of the City of Austin continues to increase as well. Census data indicate that the City of Austin experienced a 7.6 percent population increase between April 2000 (population 656,562) and July 2006 (population 709,893) (U.S. Census Bureau 2009a, p. 1). The Austin blind salamander's restricted range within a highly urbanized area makes it vulnerable to both acute and chronic groundwater contamination, potentially catastrophic hazardous materials spills, and loss of adequate springflow at Barton Springs.

Water quality degradation: As human population growth and urbanized development increases, more opportunities exist for the chronic, long-term introduction of non-point source pollutants into the environments. For example, the ongoing application of pesticides and fertilizers to lawns is a constant source of pollutants (Menzer and Nelson 1980, pp. 663, 637-652). Petroleum products are also inherent components of urban environments from automobile operation and maintenance (Van Metre *et al*. 2000, p. 4069). During rain events, these chemical pollutants, which accumulate in soils and on impervious surfaces (such as roofs, parking lots, and roads) during dry periods, are transported by water downstream into areas where salamanders occur. This process can occur either through direct surface water runoff or through infiltration into groundwater that later discharges through springs (Schram 1995, p. 91). Acute short-term increases in pollutants, particularly sediments, can occur during construction of new development. When vegetation is removed and rain falls on unprotected soils, large discharges of suspended sediments result and can have immediate effects of increased sedimentation in downstream drainage channels (Schueler 1987, p. 1.4; City of Austin 2003, p. 24).

Amphibians, especially their eggs and larvae (which are usually restricted to a small area within an aquatic environment), are sensitive to many different aquatic pollutants (Harfenist *et al*. 1989, pp. 4-57). Contaminants found in aquatic pollutants may interfere with a salamander's ability to develop, grow, or reproduce (Burton and Ingersoll 1994, pp. 120, 125). In addition, macroinvertebrates, such as small freshwater crustaceans, that aquatic salamanders feed on are especially sensitive to water pollution (Phipps *et al*. 1995, p. 282; Miller *et al*. 2007, p. 74). Studies in the Bull Creek watershed in Austin, Texas, found a loss of some sensitive macroinvertebrate species, potentially due to nutrient enrichment and sediment accumulation (City of Austin 2001, p. 15).

Increases in impervious cover resulting from urbanization have been shown to cause measurable water quality degradation (Klein 1979, p. 959; Bannerman *et al*. 1993, pp. 251-254, 256-258;

Center for Watershed Protection 2003, p. 91). Impervious cover in a stream's watershed causes streamflow to shift from predominately baseflow, which is derived from natural filtration processes and discharges from local groundwater supplies, to predominately stormwater runoff. Stormflows carry pollutants and contaminants into stream systems (Bannerman *et al*. 1993, pp. 251-254, 256-258; Schueler 1994, p. 102; Barrett and Charbeneau 1996, p. 87; Center for Watershed Protection 2003, p. 91). With increasing stormflows, the amount of baseflow available to sustain water supplies during drought cycles is diminished and the frequency and severity of flooding increases. The increased quantity and velocity of runoff increases erosion and streambank destabilization, which in turn leads to increased sediment loadings, channel widening, and detrimental changes in the morphology and aquatic ecology of the affected stream system (Hammer 1972, pp. 1535-1536, 1540; Booth 1990, pp. 407-409, 412-414; Booth and Reinelt 1993, pp. 548-550; Schueler 1994, pp. 106-108; Pizzuto *et al*. 2000, p. 82; Center for Watershed Protection 2003, pp. 41-48).

Both nationally and locally, consistent relationships between impervious cover and water quality degradation have been documented. The Lower Colorado River Authority (LCRA 2002, pp. 3-54-3-55) conducted a water supply study of the recharge and contributing zone areas within the Barton Springs Segment of the Edwards Aquifer that examined the amount of impervious cover within the local area. The eight watersheds within the area had a range of impervious cover from 3.2 percent to 28.9 percent in 2000. The projected impervious cover limits for the same eight watersheds in 2025 ranged from 4.8 percent to 31.6 percent (LCRA 2002, pp. 4-12-4-13). The two watersheds, Williamson Creek and Sunset Valley Creek (a tributary to Williamson Creek), with the highest percentage of impervious cover are also the second and third closest to the Barton Springs. In a study of pollutant loads from various land use areas in Austin, stormwater runoff pollutant loads were found to increase with increasing impervious cover. This study also found that pollutant loading rates of the more urbanized watersheds were higher than those of the small suburban watersheds (City of Austin 1990, pp. 12-14). Soeur *et al*. (1995, p. 565) determined that stormwater pollution loadings were correlated with development intensity in Austin.

Elevated mobilization of sediment (mixture of silt, sand, clay, and organic debris) also occurs as a result of increased velocity of water running off impervious surfaces in the urban environment (Schram 1995, p. 88; Arnold and Gibbons 1996, pp. 244-245). Increased rates of storm water runoff cause erosion by scouring in headwater areas and sediment deposition in downstream channels (Booth 1991, pp. 93, 102-105; Schram 1995, p. 88). Sediments are washed into streams or aquifers during storm events. Sediments are either deposited into layers or become suspended in the water column (Ford and Williams 1989, p. 537; Mahler and Lynch 1999, p. 13). Sediment derived from soil erosion has been cited by Menzer and Nelson (1980, p. 632) as the greatest single source of pollution of surface waters by volume. Due to high organic carbon content, sediments eroded from contaminated soil surfaces can concentrate and transport contaminants (Mahler and Lynch 1999, p. 1). Sediment can affect aquatic organisms in a number of ways. Sediments suspended in water can clog gill structures, which impairs breathing of aquatic organisms, and can reduce their ability to avoid predators or locate food sources due to decreased visibility (Schueler 1987, p. 1.5).

Excessive nutrient input to watershed drainages is another form of pollution that occurs in highly urbanized areas. Sources of excessive nutrients (elements or compounds, such as phosphorus or nitrogen, that fuel abnormally high organic growth in aquatic ecosystems) in water include human and animal wastes, municipal sewage treatment systems, decaying plant material, and fertilizers used on croplands (Garner and Mahler 2007, p. 29). Excessive nutrient levels typically cause algal blooms that ultimately die back and cause progressive decreases in dissolved oxygen concentration in the water from decomposition (Schueler 1987, pp. 1.5-1.6). Increased nitrate levels, which are often associated with fertilizer use, have been known to affect amphibians by altering feeding activity and by causing disequilibrium and physical abnormalities (Marco *et al*. 1999, p. 2,837).

Polycyclic aromatic hydrocarbons (PAHs) are another form of aquatic pollution in urbanized areas that could potentially affect Austin blind salamanders, their habitat, or their prey. PAHs can originate from petroleum products, such as oil or grease, or from atmospheric deposition from the byproducts of combustion (for example, vehicular combustion). These pollutants are widespread and can contaminate water supplies through sewage effluents, urban and highway runoff, and chronic leakage or acute spills of petroleum and petroleum products from pipelines (Van Metre *et al*. 2000, p. 4,067, Albers 2003, pp. 345-346). Petroleum and petroleum byproducts can adversely affect living organisms by causing direct toxic action, altering water chemistry, reducing light, and decreasing food availability (Albers 2003, p. 349). PAH exposure can cause impaired reproduction; reduced growth and development; and tumors or cancer in species of amphibians, reptiles, and other organisms (Albers 2003, p. 354). PAHs are also known to cause death, reduced survival, altered physiological function, inhibited reproduction, and changes in Austin blind salamander populations and community composition of freshwater invertebrates (Albers 2003, p. 352).

In an analysis performed by the City of Austin (2005, p. 6), significant changes over time were reported for several chemical constituents and physical parameters in Barton Springs Pool. Conductivity, turbidity, sulfates, and total organic carbon have increased while the concentration of dissolved oxygen has decreased (City of Austin 2005, pp. 8-17). The significance and presence of trends are variable depending on flow conditions (baseflow vs. stormflow, recharge vs. non-recharge) and could be attributed to impacts from watershed urbanization. These data indicate a long-term trend of water quality degradation at Barton Springs over a 25-year period (1980 to 2005).

Four pesticides (atrazine, carbaryl, diazinon, and simazine) were documented at Barton Springs Pool and Eliza Springs in water samples taken during and after a two-day storm event (Mahler and Van Metre 2000, pp. 1, 6, 8). Atrazine, carbaryl, diazinon, and simazine at the springs were found at levels below the exhibited toxicity to aquatic animals. Although concentrations of these pesticides are below criteria set in the aquatic life protection section of the Texas Surface Water Quality Standards, increases in pesticide concentrations could adversely affect aquatic organisms.

The Austin blind salamander and its prey species are directly exposed to sediment-borne contaminants in the aquifer and discharging through the spring outlets. Trace metals, such as arsenic, cadmium, copper, lead, nickel, and zinc, and sediment were found in Barton Springs in the early 1990s (City of Austin 1997, p. 229, 231-232). Adverse effects to the salamander and its prey species may occur when water quality criteria for sediment contaminants are exceeded. These effects may include reduced growth and weight, abnormal behavior, morphological and developmental aberrations, and decreased reproductive activity (Albers 2003, p. 354).

Water quantity and spring flow declines: Another threat to the Austin blind salamander and its ecosystem involves low flow conditions in the Edwards Aquifer and at Barton Springs. The long-term mean flow at the Barton Springs outlets is approximately 53 cubic feet per second (cfs) (City of Austin 1998, p. 13; Barton Springs/Edwards Aquifer Conservation District 2004, p. 10). The lowest flow recorded at Barton Springs was about 10 cfs during a record drought in the 1950s (City of Austin 1998, p. 13). Discharge at Barton Springs decreases as water levels in the Barton Springs Segment of the Edwards Aquifer drop. Large declines in aquifer levels have historically been due to a lack of adequate rainfall recharging the aquifer. In a 2004 groundwater flow modeling study, the Barton Springs Edwards Aquifer Conservation District predicted that under drought-of-record conditions and current pumping levels, the mean monthly springflow would be about 1 cfs. This study also indicated that under drought-of-record conditions, projected pumping rates for future years would cause Barton Springs to cease flowing for at least four months out of a year (Barton Springs/Edwards Aquifer Conservation District 2004, pp. 1, 20, 24). It is unknown what the anticipated outcome would be for the Austin blind salamander under this scenario.

Future climate change could affect water quantity and spring flow for this aquatic species. According to the Intergovernmental Panel on Climate Change (IPCC 2007, p. 1), "warming of the climate system is unequivocal, as is now evident from observations of increases in global averages of air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level." Localized projections suggest the southwest United States may experience the greatest temperature increase of any area in the lower 48 states (IPCC 2007, p. 8), with warming increases in southwestern states greatest in the summer. The IPCC also predicts hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007, p.8).

Climate change could compound the threat of decreased water quantity at Barton Springs. An increased risk of drought could occur if evaporation exceeds precipitation levels in a particular region due to increased greenhouse gases in the atmosphere (CH2M HILL 2007, p. 18). The Edwards Aquifer is also predicted to experience additional stress from climate change that could lead to decreased recharge and low or ceased springflows given its pumping demands (Loáiciga *et al*. 2000, pp. 192-193). CH2M HILL (2007, pp. 22-23) identified possible effects of climate change on water resources within the Lower Colorado River Watershed (which contributes recharge to Barton Springs). A reduction of recharge to aquifers and a greater likelihood for more extreme droughts were identified as potential impacts to water resources (CH2M HILL 2007, p. 23).

Human population growth and urbanization within the vicinity of the City of Austin continue to increase rapidly. Urbanization can dramatically alter the hydrologic regime and water quality of watershed drainages (Klein 1979, p. 959; Bannerman *et al*. 1993, pp. 251-254, 256-258; Center for Watershed Protection 2003, p. 91). The Austin blind salamander also faces alterations to its habitat from a reduction in recharge entering the Barton Springs Segment of the Edwards Aquifer, on which it depends. The known range of the Austin blind salamander is entirely located within and around three spring openings within the City of Austin. Therefore, we consider the destruction or modification of habitat due to acute or chronic water quality degradation in the Barton Springs Segment of the Edwards Aquifer or loss of flow at Barton Springs to be a threat to the Austin blind salamander now and in the foreseeable future.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
We are not aware of any information regarding overutilization of Austin blind salamanders for commercial, recreational, scientific, or educational purposes and do not consider this a significant factor threatening this species now or in the foreseeable future.

C. Disease or predation.
A pathological condition affecting Barton Springs salamanders may also threaten the Austin blind salamander. Between January 28, 2002, and June 26, 2002, 17 Barton Springs salamanders were found at Upper Barton Springs and 2 at Sunken Garden Springs, where the Austin blind salamander also occurs, with bubbles of gas occurring throughout their bodies. Three similarly affected Barton Springs salamanders also were found at Upper Barton Springs in February and March 2003 (Dee Ann Chamberlain, City of Austin, pers. comm. 2003). Of the 19 salamanders affected in 2002, 12 were found dead or died shortly after they were found. Both adult and juvenile Barton Springs salamanders have been affected (Chamberlain and O'Donnell 2003, pp. 10, 17).

The incidence of gas bubbles in salamanders at Barton Springs is consistent with a disorder known as gas bubble disease or gas bubble trauma, as described by Weitkamp and Katz (1980, pp. 664-671). In animals with gas bubble trauma, bubbles below the surface of the body and inside the cardiovascular system produce lesions and necrotic tissue that can lead to secondary infections (Weitkamp and Katz 1980, p. 670). Death from gas bubble trauma is apparently related to an accumulation of internal bubbles in the cardiovascular system (Weitkamp and Katz 1980, p. 668). Pathology reports on affected animals at Barton Springs found that the symptoms were consistent with gas bubble trauma and that no other problems such as pathogens were indicated (Dee Ann Chamberlain, City of Austin, pers. comm. 2003).

Although gas bubble trauma has been detected in Barton Springs salamanders, no Austin blind salamanders have been found with this condition (Chamberlain and O'Donnell 2003, pp. 10, 17). However, this species is dependent on similar habitat conditions as the Barton Springs salamander. Also, several other amphibian, fish, and invertebrate species at Barton Springs have been found with the characteristics similar to those which are caused by this condition. Therefore, we consider gas bubble trauma to be a threat to the Austin blind salamander now and in the foreseeable future.

D. The inadequacy of existing regulatory mechanisms.
The Austin blind salamander is not listed on the Texas State List of Threatened or Endangered Species (Texas Parks and Wildlife Department (TPWD 2010, pp. 2-3). Therefore, it is receiving no direct protection from the State.

Nonpoint source pollution controls are required in a variety of local ordinances, which range from relatively strict controls by the City of Austin in its extraterritorial jurisdiction to lesser controls in outlying areas. Some of the protections provided in these ordinances include riparian buffers, permanent water quality control structures, and impervious cover limitations. The Texas Commission on Environmental Quality (TCEQ) also adopted the Edwards Rules in 1995 and 1997, which require a number of water quality protection measures for new development occurring in the recharge and contributing zones of the Edwards Aquifer. Although there are no restrictions on impervious cover in the Edwards Rules, the regulations do provide incentives to developers in the form of exemptions and exceptions from permanent water quality control mechanisms for developments with less than 20 percent impervious cover.

Based on trend data that show degradation of water quality at Barton Springs over the years (City of Austin 2005, pp. 8-17), existing regulations for maintaining water quality may not adequately protect the Barton Springs and the Austin blind salamanders. To date, no comprehensive study has been conducted to evaluate the effectiveness of existing state and local regulations in protecting water quality in the Barton Springs watershed. In addition, Chapter 245 of the Texas Local Government Code permits "grandfathering" of State regulations. Grandfathering allows developments to be exempted from any new local or State requirements for water quality controls and impervious cover limits providing that the developments were planned prior to the implementation of such regulations. However, these developments are still obligated to comply with regulations that were applicable at the time when project applications for development were first filed. The potential impact of the grandfathering statute as enacted by the State of Texas has not been examined with respect to existing regulations that protect water quality in the Barton Springs watershed.

The Austin blind salamander occurs within the range of the federally listed Barton Springs salamander; therefore, any protections designed to alleviate threats to the Barton Springs salamander will also be afforded to the Austin blind salamander. Human population growth within the vicinity of the City of Austin continues to increase rapidly. Existing regulations do not address many of the sources of groundwater pollution that are typically associated with urbanized areas. Therefore, we conclude that the protections from the existing regulatory mechanisms are not adequate to alleviate the threats to the Austin blind salamander.

E. Other natural or manmade factors affecting its continued existence.
We are not aware of any information regarding other natural or manmade factors affecting the Austin blind salamanders' continued existence. Therefore, we have determined that there are no other natural or manmade factors significantly affecting this species now or in the foreseeable future that constitutes a threat to the Austin blind salamander.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED: The conservation actions listed below were primarily undertaken to protect the endangered Barton Springs salamander. Because the Austin blind salamander is sympatric with the Barton Springs salamander and has similar habitat requirements, this species is benefiting from these actions as well.

1. Land acquisition - Land acquisition in the Barton Springs watershed benefits both the Barton Springs and the Austin blind salamanders through preservation of open space, and therefore water quality, over the recharge zone. The City of Austin has acquired (including fee title purchases and conservation easements) over 16,600 acres (6,718 hectares) of open space within

the Barton Springs watershed. The City of Austin and Travis County have purchased land within the Barton Springs watershed as mitigation for a regional habitat conservation plan for other listed, terrestrial species. In addition, the Nature Conservancy has purchased property within the Barton Springs watershed that likely provides water quality benefits to the Austin blind salamander. Other organizations such as the Hill Country Conservancy are working to set aside open space to preserve land and water quality.

Thousands of acres over the Barton Springs Segment of the Edwards Aquifer have already been set aside for conservation purposes and may be beneficial to the Austin blind salamander by protecting water quality. It is reasonably certain that more land acquisition over this segment of the aquifer will take place in the future and that this land will contribute to the protection of water quality at Barton Springs.

2. Water Quality Protection Recommendations - In September 2000, a set of water quality protection recommendations were developed and distributed to local jurisdictions within the Barton Springs watershed. They were also incorporated into a Memorandum of Understanding between the Service and the LCRA to off-set impacts from the LCRA pipeline, a project designed to bring a reliable water supply to development in a portion of the Barton Springs watershed. A working group, which represented broad expertise in water quality protection technology and consisted of staff from City of Austin, LCRA, University of Texas at Austin, and local engineering firms, developed this document in an effort to outline site-specific management actions designed to minimize water quality degradation from new development in the Barton Springs watershed. In addition to developments receiving water from the LCRA pipeline, these recommendations have also been used in other large developments to help minimize water quality impacts within the Barton Springs watershed.

The TCEQ has developed voluntary water quality protection measures for developers to minimize water quality effects to springs systems and other aquatic habitats within the Edwards Aquifer region of Texas. In February 2005, the Service concurred that these measures, if implemented, would protect several aquatic species from "take" that would otherwise occur due to water quality degradation resulting from development in the Edwards Aquifer region. Although the Austin blind salamander was not specifically named in this concurrence, the measures, if implemented, could affect this species.

3. City of Austin and Texas Department of Transportation National Pollutant Discharge Elimination System (NPDES) Permits - The City of Austin and Texas Department of Transportation are monitoring development and traffic to provide data necessary to implement a long-term program to reduce pollutant loading.

4. City of Austin's Watershed Protection Master Plan - The City of Austin's Watershed Protection and Development Review Department is developing a Watershed Protection Master Plan to characterize watershed management needs and prioritize potential solutions for Austin area watersheds, including those within the Barton Springs Segment of the Edwards Aquifer (City of Austin 2009, p. 1).

5. Efforts to Protect Surface Habitat - The City of Austin is implementing a habitat conservation

plan (HCP) to avoid, minimize, and mitigate incidental take of the Barton Springs salamander resulting from the continued operation and maintenance of Barton Springs Pool and adjacent springs (City of Austin 1998, pp. 1-53). Many of the provisions of the plan also benefit the Austin blind salamander. Such provisions include: (a) training lifeguard and maintenance staff to protect salamander habitat, (b) controlling erosion and preventing surface runoff from entering the springs, (c) ecological enhancement and restoration, (d) monthly monitoring of salamander numbers, (e) public outreach and education, and (f) establishment and maintenance of a captive breeding program which includes the Austin blind salamander.

6. Barton Springs/Edwards Aquifer Conservation District's HCP - The Barton Springs/Edwards Aquifer Conservation District was awarded a section 6 grant from the Service to develop an HCP for the Barton Springs salamander. The conservation district is actively working on this HCP that will examine the groundwater flows to and from Barton Springs, the pumping of wells in the Aquifer, and the effects of pumping and spring flow under drought conditions on water quantity, water chemistry, and water quality in Barton Springs. Impacts to both the Barton Springs salamander and the Austin blind salamander will be studied. The overall goal of the District's HCP process is to protect both the Barton Springs and the Austin blind salamanders while providing a requisite water supply to the people who are dependent on the Edwards Aquifer.

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate): The primary threats facing the Austin blind salamander are the degradation of the quality and quantity of water that feeds Barton Springs as a result of urban expansion over the watershed. The restricted range of the salamander makes it vulnerable to both acute and chronic groundwater contamination. The salamander is also vulnerable to catastrophic hazardous materials spills, increased water withdrawals from the Edwards Aquifer, and impacts to its habitat. Many conservation efforts that are currently underway for the Barton Springs salamander benefit the Austin blind salamander as well. Thousands of acres have been preserved within the recharge and contributing zones that supply water to the spring habitat for this species. Such land preservation helps protect the Austin blind salamander and its habitat from water quality degradation that would likely occur if these lands were developed. The City of Austin and the Texas Commission on Environmental Quality have developed guidelines for developers to minimize water quality effects to spring systems and other aquatic habitats. Also, the City of Austin is actively working to control erosion and restore quality habitat for the Barton Springs and Austin blind salamanders at Barton Springs. Thus, we believe it is likely that the potential for chronic water quality degradation at Barton Springs has been lessened by the watershed-based approach to conserve these salamander species. However, because development within Travis County continues and because the threat of a hazardous material spill into Barton Springs remains, the Service finds that this species continues to be warranted for listing throughout all of its range. We therefore find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

____Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES: Since this species occurs in and around three of the spring sites that are also known to support the endangered Barton Springs salamander, recommended conservation measures follow those outlined for the Barton Springs salamander in the Barton Springs Salamander Recovery Plan (Service 2005, pp. 2.1-1-2.1-6). Such conservation efforts should include implementing comprehensive regional plans to address water quality and quantity threats. A plan to protect or enhance water quality should include measures for projects constructed over contributing and recharge zones of the Barton Springs Segment of the Edwards Aquifer. Such measures should include impervious cover limits, buffer zones for streams and other sensitive environmental features, low-impact developments, structural water quality controls and other strategies to reduce pollutant loads. Land preservation through acquisition, conservation easements, or deed restrictions also can provide permanent protection for water quality and quantity. Programs should be developed to reduce pollutant loading from already existing development and other potential sources of pollutants such as golf courses and transportation infrastructure. The City of Austin should continue their efforts to protect the salamander's habitat. Also, the Austin blind salamander is a high priority species in the Wildlife Action Plan of Texas (TPWD 2005, p. 749). This may help in securing State funds for both research and recovery efforts for this species.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: Water quality impacts threaten the continued existence of the Austin blind salamander by altering physical aquatic habitats and the food sources of the salamander. The City of Austin and many other partners are actively working on conservation of the Barton Springs salamander. The Austin blind salamander benefits from all of the ongoing conservation actions that are being conducted for the Barton Springs salamander. However, limited distribution of this species makes it extremely vulnerable to extinction from degradation of water quality and decreased water quantity. The existence of the species continues to be threatened by hazardous chemical spills within the Barton Springs Segment of the Edwards Aquifer. Because the Austin blind salamander is known from only three spring sites and must rely on clear, clean spring discharges from the Edwards Aquifer for its survival, the entire species is facing threats of a high magnitude.

Imminence: The Austin blind salamander occurs in one of the most rapidly growing regions in the United States. Data indicate a long-term trend of water quality degradation at Barton Springs over a 25-year period (City of Austin 2005, pp. 12-14). Expanding urbanization in the Barton Springs Segment of the Edwards Aquifer is currently ongoing and more development in this area is planned for the near future, making the loss of spring flow and degradation of water quality an imminent threat of habitat degradation or loss.

_X_ Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? Yes

Is Emergency Listing Warranted? Emergency listing is not warranted at this time. Because the Austin blind salamander is sympatric with the endangered Barton Springs salamander, it benefits from the conservation actions that have been and are being undertaken to recover the Barton Springs salamander.

DESCRIPTION OF MONITORING:
<u>Salamander Monitoring</u> - The City of Austin conducts monthly surveys for Barton Springs and Austin blind salamanders in Barton Springs Pool, Eliza Springs, Sunken Garden Springs, and Upper Barton Springs. The City of Austin staff also conducts daily visual inspections of all habitat areas (spring sites) and addresses problems such as vandalism, trash and debris, introduction of exotic species, or disturbance of habitat. Such monitoring activities are required in their incidental take permit for Barton Springs salamanders issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended; however, these actions provide opportunities to learn more about the Austin blind salamander as well The City of Austin reports these monitoring efforts are currently ongoing as of March 2010 (Laurie Dries, City of Austin, pers. comm. 2010).

<u>Water Quality Monitoring</u> - The City of Austin and U.S. Geological Survey regularly conduct water quality monitoring at Barton Springs. The City of Austin's water quality monitoring schedule includes:

- Continuous monitoring of pH, specific conductance, temperature, turbidity, total dissolved gas, dissolved oxygen, and depth using multiprobe data loggers in Barton Springs Pool, Eliza Springs, and Upper Barton Springs (with plans to include Sunken Garden Springs contingent on funding).

- Twice weekly testing for bacteria for Barton Springs Pool.

- Biweekly analyses of nutrients, total suspended solids, and chlorophyll A for Barton Springs Pool. A companion sample collected at the downstream dam is analyzed for total suspended solids and chlorophyll A. Field parameters measured include pH, temperature, turbidity, dissolved oxygen, and specific conductance.

- Quarterly tests for nutrients, total suspended solids, major ions, and heavy metals (arsenic, copper, iron, lead, nickel, and zinc) in all four springs. Field parameters measured include pH, temperature, turbidity, dissolved oxygen, and specific conductance.

- Semiannual analyses that include the above quarterly list of parameters in addition to a more comprehensive list of metals and organic compounds. Field parameters include pH, temperature, turbidity, dissolved oxygen, and specific conductance.

- Annual analyses at all four springs that include the above quarterly list of parameters in addition to a more comprehensive list of metals and organic compounds. Field parameters collected include pH, temperature, turbidity, dissolved oxygen, and specific conductance.

Although population estimates for this species are not available, monthly surveys for the Austin blind salamander provide information that may give an indication of the status of this species in the wild. Similarly, regular water quality monitoring helps in our understanding of the quality of the aquatic habitat on which this species depends.

COORDINATION WITH STATES: In March 2010, the Service contacted Andy Gluesenkamp, State Herpetologist for TPWD by e-mail requesting information on the status of this and other candidate species. In his response to this inquiry, Dr. Gluesenkamp did not provide new information on this species (Andy Gluesenkamp, TPWD, pers. comm. 2010).

Indicate which State(s) did not provide any information or comments: N/A

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: ______________________________ May 21, 2010
Acting Regional Director, Fish and Wildlife Service Date

Concur: ACTING
Director, Fish and Wildlife Service Date: October 22, 2010

Do not concur: ______________________________ ____________
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: April 2010
Conducted by: Paige Najvar, Austin Ecological Services